

VS-VSKT136/16PBF Datasheet

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| | |
|------------------------------|---|
| DiGi Electronics Part Number | VS-VSKT136/16PBF-DG |
| Manufacturer | Vishay General Semiconductor - Diodes Division |
| Manufacturer Product Number | VS-VSKT136/16PBF |
| Description | MODULE THYRISTOR 135A INT-A-PAK |
| Detailed Description | SCR Module 1.6 kV 300 A Series Connection - All SC Rs Chassis Mount INT-A-Pak |

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Manufacturer Product Number:

VS-VSKT136/16PBF

Series:

-

Structure:

Series Connection - All SCRs

Voltage - Off State:

1.6 kV

Current - On State (It (RMS)) (Max):

300 A

Current - Gate Trigger (Igt) (Max):

150 mA

Current - Hold (Ih) (Max):

200 mA

Mounting Type:

Chassis Mount

Base Product Number:

VSKT136

Manufacturer:

Vishay General Semiconductor - Diodes Division

Product Status:

Active

Number of SCRs, Diodes:

2 SCRs

Current - On State (It (AV)) (Max):

135 A

Voltage - Gate Trigger (Vgt) (Max):

2.5 V

Current - Non Rep. Surge 50, 60Hz (I_{tsm}):

3200A, 3360A

Operating Temperature:

-40°C ~ 125°C (Tj)

Package / Case:

INT-A-Pak

Environmental & Export classification

RoHS Status:

ROHS3 Compliant

REACH Status:

REACH Unaffected

HTSUS:

8541.30.0080

Moisture Sensitivity Level (MSL):

1 (Unlimited)

ECCN:

EAR99



VS-VSK.136..PbF, VS-VSK.142..PbF, VS-VSK.162..PbF Series

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Thyristor/Diode and Thyristor/Thyristor, 135 A to 160 A (INT-A-PAK Power Modules)



INT-A-PAK

| PRIMARY CHARACTERISTICS | |
|-------------------------|-------------------------------|
| $I_{T(AV)}$ | 135 A to 160 A |
| Type | Modules - thyristor, standard |
| Package | INT-A-PAK |

FEATURES

- High voltage
- Electrically isolated by DBC ceramic (Al_2O_3)
- 3500 V_{RMS} isolating voltage
- Industrial standard package
- High surge capability
- Glass passivated chips
- Modules uses high voltage power thyristor/diodes in three basic configurations
- Simple mounting
- UL approved file E78996 
- Designed and qualified for multiple level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT

APPLICATIONS

- DC motor control and drives
- Battery charges
- Welders
- Power converters
- Lighting control
- Heat and temperature control

| MAJOR RATINGS AND CHARACTERISTICS | | | | | |
|-----------------------------------|-----------------|-------------|-------------|-------------|--------------------|
| SYMBOL | CHARACTERISTICS | VSK.136.. | VSK.142.. | VSK.162.. | UNITS |
| $I_{T(AV)}$ | 85 °C | 135 | 140 | 160 | A |
| $I_{T(RMS)}$ | | 300 | 310 | 355 | A |
| I_{TSM} | 50 Hz | 3200 | 4500 | 4870 | |
| | 60 Hz | 3360 | 4712 | 5100 | |
| I^2t | 50 Hz | 51.5 | 102 | 119 | kA ² s |
| | 60 Hz | 47 | 92.5 | 108 | |
| $I^2\sqrt{t}$ | | 515.5 | 1013 | 1190 | kA ² √s |
| V_{RRM} | Range | 400 to 1600 | 400 to 1600 | 400 to 1600 | V |
| T_J | Range | -40 to +125 | | | °C |

ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS | | | | |
|--|--------------|--|--|-----------------------------------|
| TYPE NUMBER | VOLTAGE CODE | V_{RRM}/V_{DRM} , MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE V | V_{RSM}/V_{DSM} , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V | I_{RRM}/I_{DRM} AT 125 °C mA |
| VS-VSK.136 VS-VSK.142 VS-VSK.162 | 04 | 400 | 500 | 50 |
| | 08 | 800 | 900 | |
| | 12 | 1200 | 1300 | |
| | 14 | 1400 | 1500 | |
| | 16 | 1600 | 1700 | |



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| ON-STATE CONDUCTION | | | | | | | |
|--|---------------|---|----------------------------|---------|---------|---------|--------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VSK.136 | VSK.142 | VSK.162 | UNITS |
| Maximum average on-state current at case temperature | $I_{T(AV)}$ | 180° conduction, half sine wave | | 135 | 140 | 160 | A |
| | | | | 85 | 85 | 85 | °C |
| Maximum RMS on-state current | $I_{T(RMS)}$ | As AC switch | | 300 | 310 | 355 | A |
| Maximum peak, one-cycle on-state, non-repetitive surge current | I_{TSM} | t = 10 ms | No voltage reappplied | 3200 | 4500 | 4870 | |
| | | t = 8.3 ms | No voltage reappplied | 3360 | 4712 | 5100 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 2700 | 3785 | 4100 | |
| | | t = 8.3 ms | 100 % V_{RRM} reappplied | 2800 | 3963 | 4300 | |
| Maximum I^2t for fusing | I^2t | t = 10 ms | No voltage reappplied | 51.5 | 102 | 119 | kA ² s |
| | | t = 8.3 ms | No voltage reappplied | 47 | 92.5 | 108 | |
| | | t = 10 ms | 100 % V_{RRM} reappplied | 36.5 | 71.6 | 84 | |
| | | t = 8.3 ms | 100 % V_{RRM} reappplied | 33.3 | 65.4 | 76.7 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 ms to 10 ms, no voltage reappplied | | 515.5 | 1013 | 1190 | kA ² √s |
| Low level value of threshold voltage | $V_{T(TO)1}$ | (16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$), T_J maximum | | 0.86 | 0.83 | 0.8 | V |
| High level value of threshold voltage | $V_{T(TO)2}$ | (I > $\pi \times I_{T(AV)}$), T_J maximum | | 1.05 | 1 | 0.98 | |
| Low level value on-state slope resistance | r_{t1} | (16.7 % $\times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}$), T_J maximum | | 2.02 | 1.78 | 1.67 | mΩ |
| High level value on-state slope resistance | r_{t2} | (I > $\pi \times I_{T(AV)}$), T_J maximum | | 1.65 | 1.43 | 1.38 | |
| Maximum on-state voltage drop | V_{TM} | $I_{TM} = \pi \times I_{T(AV)}$, $T_J = 25^\circ\text{C}$, 180° conduction | | 1.57 | 1.55 | 1.54 | V |
| Maximum forward voltage drop | V_{FM} | $I_{TM} = \pi \times I_{T(AV)}$, $T_J = 25^\circ\text{C}$, 180° conduction | | 1.57 | 1.55 | 1.54 | V |
| Maximum holding current | I_H | Anode supply = 6 V initial $I_T = 30$ A, $T_J = 25^\circ\text{C}$ | | 200 | | | mA |
| Maximum latching current | I_L | Anode supply = 6 V resistive load = 1 Ω Gate pulse: 10 V, 100 μs, $T_J = 25^\circ\text{C}$ | | 400 | | | |

| SWITCHING | | | | | |
|-----------------------|----------|---|--|-----------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Typical delay time | t_{gd} | $T_J = 25^\circ\text{C}$ | Gate current = 1 A, $di_g/dt = 1$ A/μs $V_d = 0.67\%$ V_{DRM} | 1 | μs |
| Typical rise time | t_{gr} | | | 2 | |
| Typical turn-off time | t_q | $I_{TM} = 300$ A, $-di/dt = 15$ A/μs; $T_J = T_J$ maximum $V_R = 50$ V; $dV/dt = 20$ V/μs; gate 0 V, 100 Ω | | 50 to 200 | |

| BLOCKING | | | | | |
|--|--------------------------|--|--|--------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum peak reverse and off-state leakage current | I_{RRM} , I_{DRM} | $T_J = 125^\circ\text{C}$ | | 50 | mA |
| RMS insulation voltage | V_{INS} | 50 Hz, circuit to base, all terminals shorted, t = 1 s | | 3500 | V |
| Critical rate of rise of off-state voltage | dV/dt | $T_J = T_J$ maximum, exponential to 67 % rated V_{DRM} | | 1000 | V/μs |



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| TRIGGERING | | | | | |
|---|-------------|---|---|--------|------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES | UNITS |
| Maximum peak gate power | P_{GM} | $t_p \leq 5$ ms, $T_J = T_J$ maximum | | 12 | W |
| Maximum average gate power | $P_{G(AV)}$ | $f = 50$ Hz, $T_J = T_J$ maximum | | 3 | |
| Maximum peak gate current | I_{GM} | $t_p \leq 5$ ms, $T_J = T_J$ maximum | | 3 | A |
| Maximum peak negative gate voltage | $-V_{GT}$ | | | 10 | V |
| Maximum required DC gate voltage to trigger | V_{GT} | $T_J = -40$ °C | Anode supply = 6 V, resistive load; $R_a = 1$ Ω | 4 | |
| | | $T_J = 25$ °C | | 2.5 | |
| | | $T_J = T_J$ maximum | | 1.7 | |
| Maximum required DC gate current to trigger | I_{GT} | $T_J = -40$ °C | | 270 | mA |
| | | $T_J = 25$ °C | | 150 | |
| | | $T_J = T_J$ maximum | | 80 | |
| Maximum gate voltage that will not trigger | V_{GD} | $T_J = T_J$ maximum, rated V_{DRM} applied | | 0.3 | V |
| Maximum gate current that will not trigger | I_{GD} | | | 10 | mA |
| Maximum rate of rise of turned-on current | di/dt | $T_J = T_J$ maximum, $I_{TM} = 400$ A rated V_{DRM} applied | | 300 | A/ μ s |

| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | | |
|---|----------------------------------|--|-------------|---------|---------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VSK.136 | VSK.142 | VSK.162 | UNITS |
| Maximum junction operating temperature range | T_J | | -40 to +125 | | | °C |
| Maximum storage temperature range | T_{Stg} | | -40 to +150 | | | |
| Maximum thermal resistance, junction to case per junction | R_{thJC} | DC operation | 0.18 | 0.18 | 0.16 | K/W |
| Maximum thermal resistance, case to heatsink per module | R_{thCS} | Mounting surface, smooth, flat and greased | 0.05 | | | |
| Mounting torque ± 10 % | IAP to heatsink busbar to IAP | A mounting compound is recommended and the torque should be rechecked after a period of 3 hours to allow for the spread of the compound. Lubricated threads. | 4 to 6 | | | Nm |
| Approximate weight | | | 200 | | | g |
| Case style | | | 7.1 | | | oz. |
| | | | INT-A-PAK | | | |

| ΔR CONDUCTION PER JUNCTION | | | | | | | | | | | |
|------------------------------------|--|--------|--------|--------|--------|---|--------|--------|--------|--------|-------|
| DEVICES | SINUSOIDAL CONDUCTION AT T_J MAXIMUM | | | | | RECTANGULAR CONDUCTION AT T_J MAXIMUM | | | | | UNITS |
| | 180° | 120° | 90° | 60° | 30° | 180° | 120° | 90° | 60° | 30° | |
| VSK.136 | 0.007 | 0.01 | 0.013 | 0.0155 | 0.017 | 0.009 | 0.012 | 0.014 | 0.015 | 0.017 | K/W |
| VSK.142 | 0.0019 | 0.0019 | 0.0020 | 0.0020 | 0.0021 | 0.0018 | 0.0022 | 0.0023 | 0.0023 | 0.0020 | |
| VSK.162 | 0.0030 | 0.0031 | 0.0032 | 0.0033 | 0.0034 | 0.0029 | 0.0036 | 0.0039 | 0.0041 | 0.0040 | |

Note

- Table shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC



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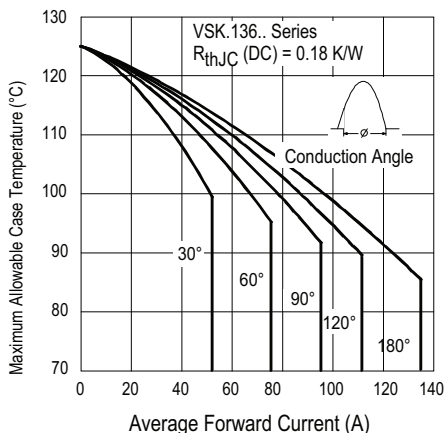


Fig. 1 - Current Ratings Characteristics

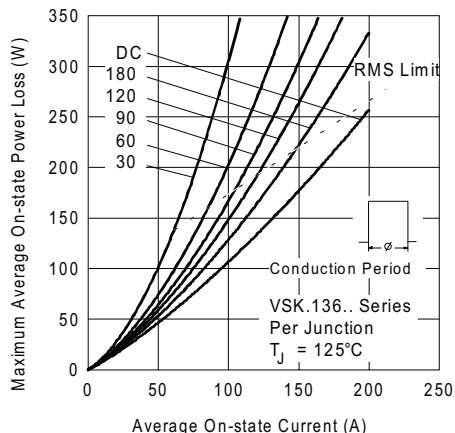


Fig. 4 - On-State Power Loss Characteristics

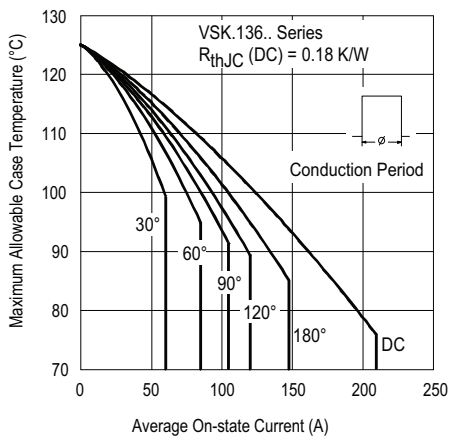


Fig. 2 - Current Ratings Characteristics

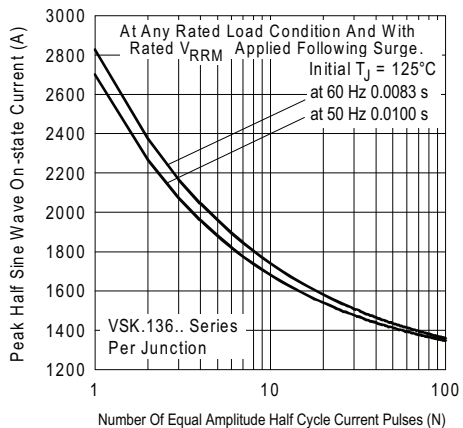


Fig. 5 - Maximum Non-Repetitive Surge Current

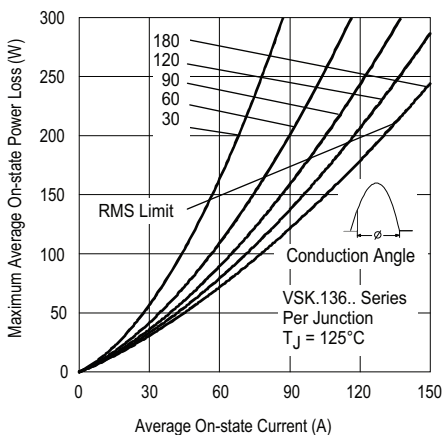


Fig. 3 - On-State Power Loss Characteristics

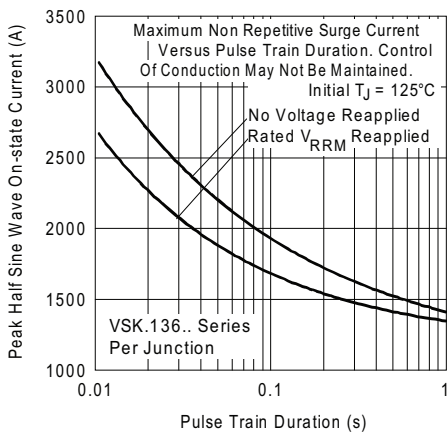


Fig. 6 - Maximum Non-Repetitive Surge Current



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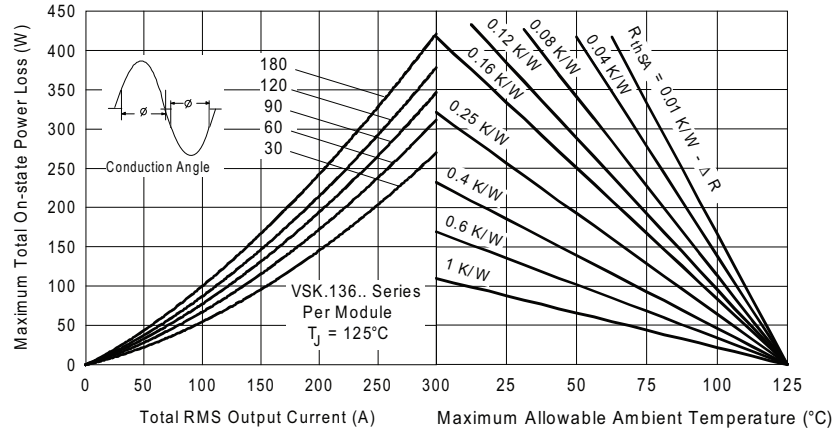


Fig. 7 - On-State Power Loss Characteristics

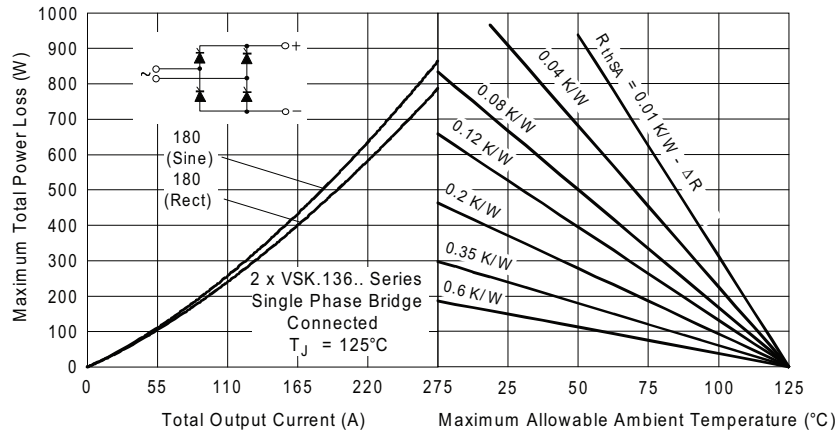


Fig. 8 - On-State Power Loss Characteristics

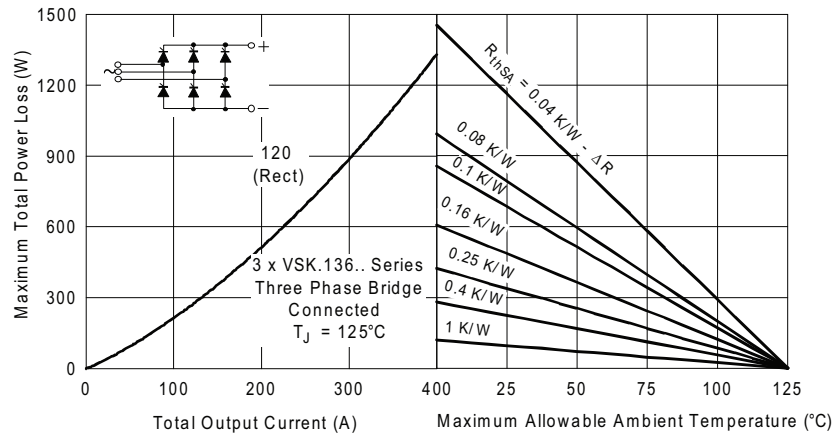


Fig. 9 - On-State Power Loss Characteristics



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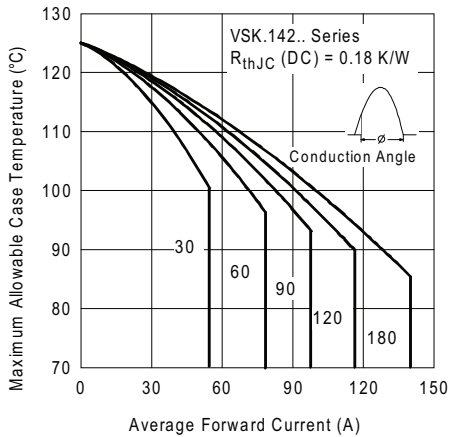


Fig. 10 - Current Ratings Characteristics

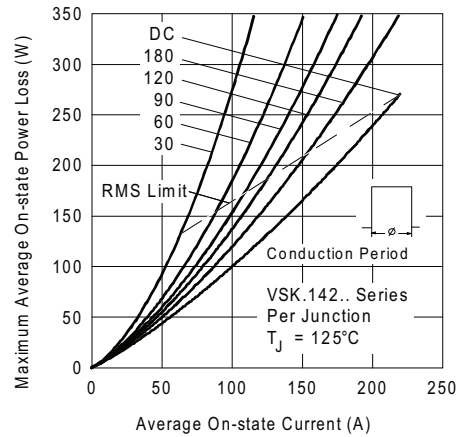


Fig. 13 - On-State Power Loss Characteristics

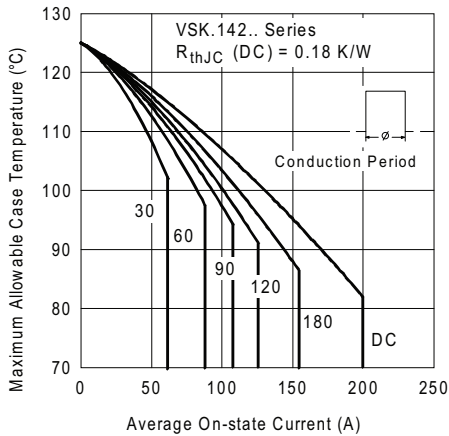


Fig. 11 - Current Ratings Characteristics

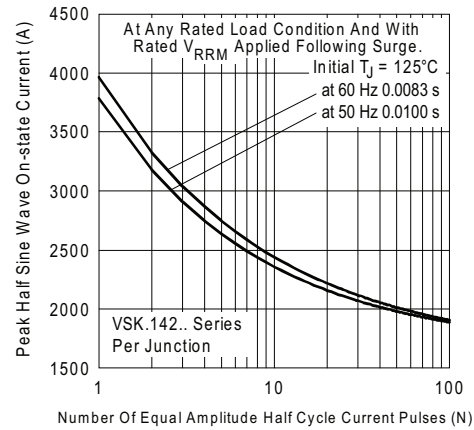


Fig. 14 - Maximum Non-Repetitive Surge Current

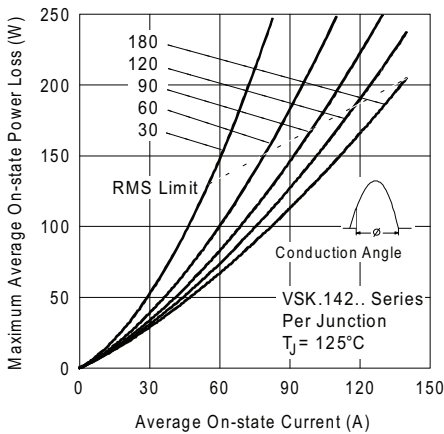


Fig. 12 - On-State Power Loss Characteristics

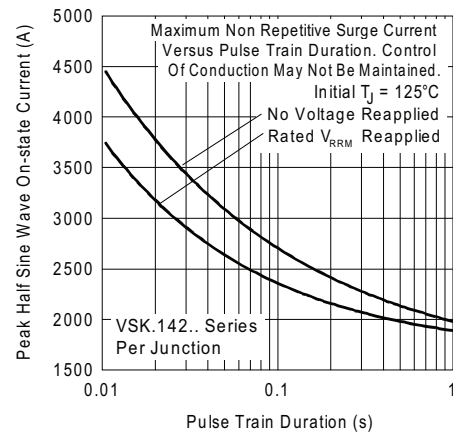


Fig. 15 - Maximum Non-Repetitive Surge Current



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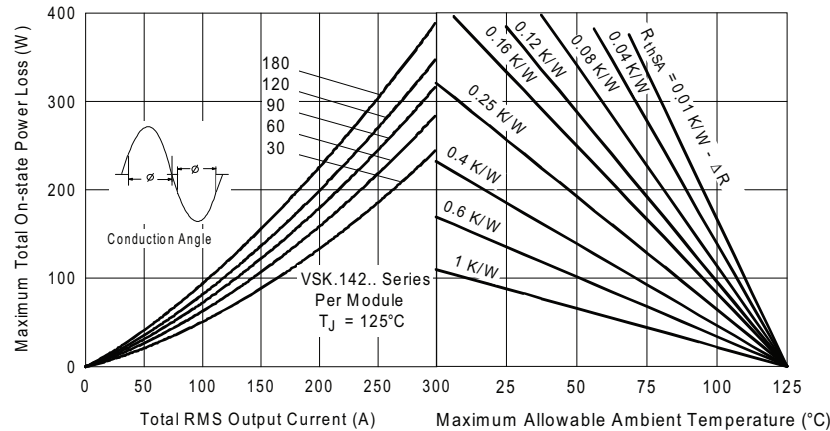


Fig. 16 - On-State Power Loss Characteristics

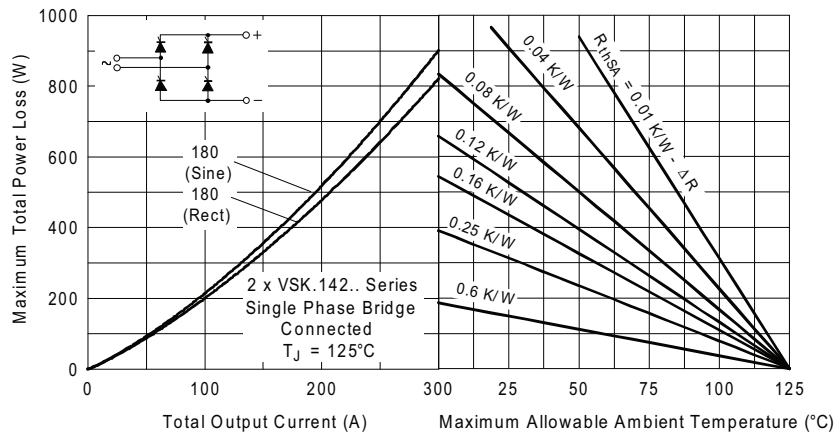


Fig. 17 - On-State Power Loss Characteristics

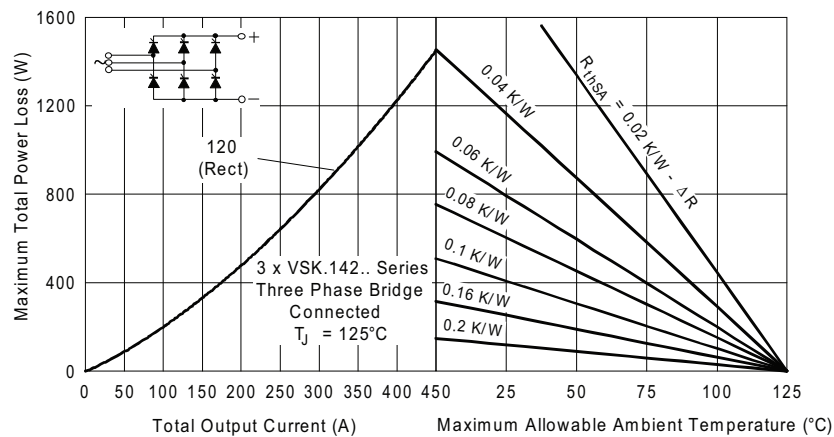


Fig. 18 - On-State Power Loss Characteristics



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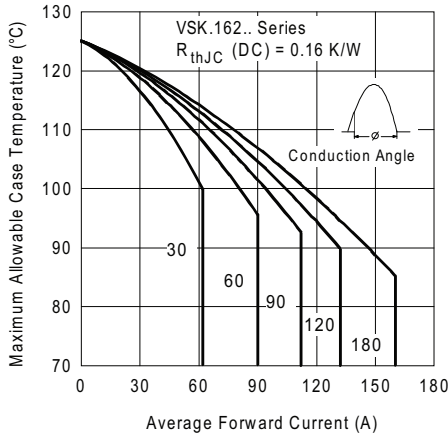


Fig. 19 - Current Ratings Characteristics

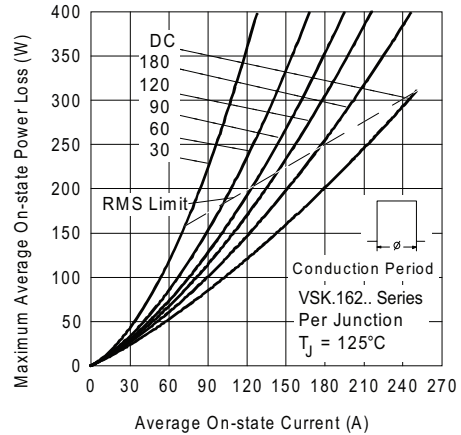


Fig. 22 - On-State Power Loss Characteristics

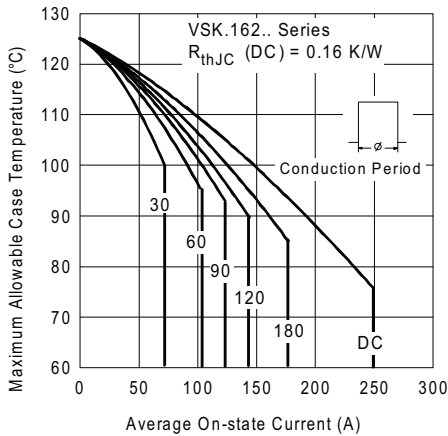


Fig. 20 - Current Ratings Characteristics

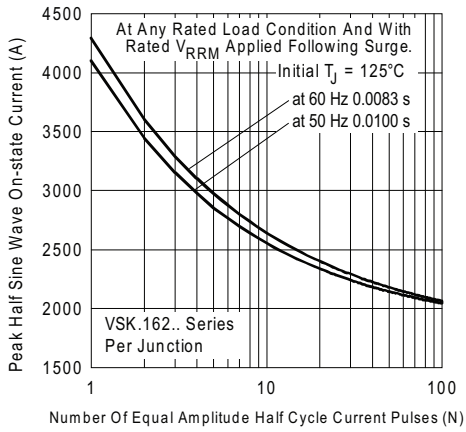


Fig. 23 - Maximum Non-Repetitive Surge Current

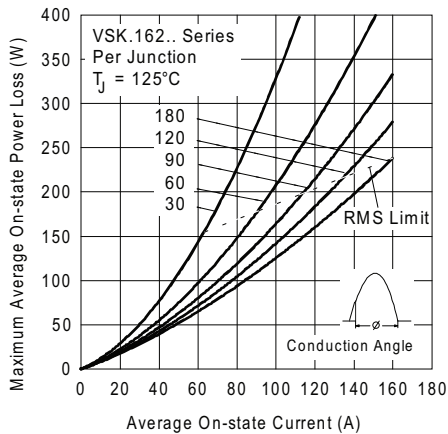


Fig. 21 - On-State Power Loss Characteristics

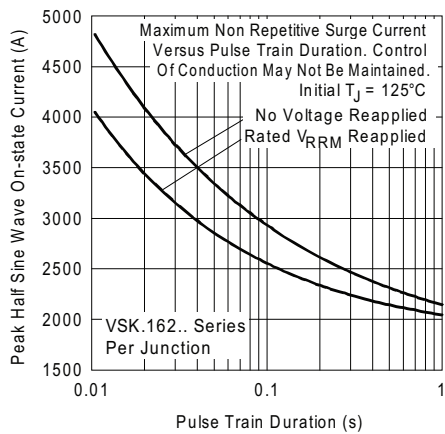


Fig. 24 - Maximum Non-Repetitive Surge Current



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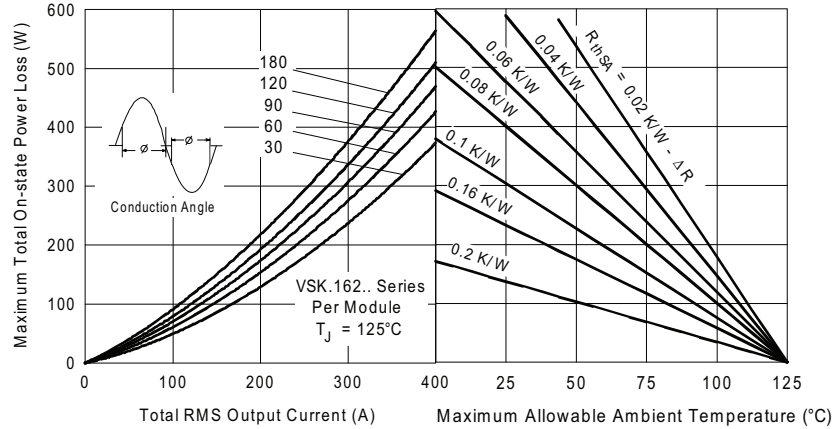


Fig. 25 - On-State Power Loss Characteristics

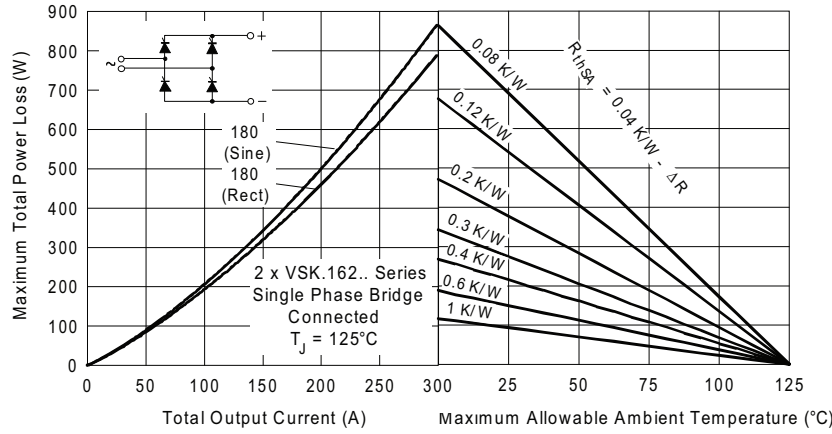


Fig. 26 - On-State Power Loss Characteristics

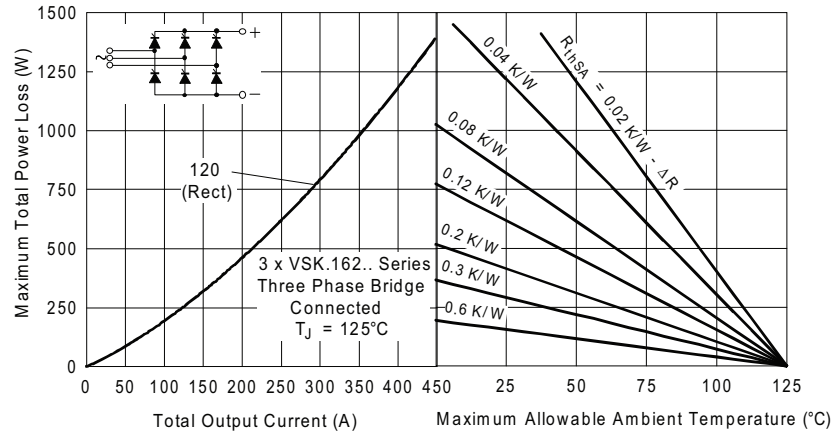


Fig. 27 - On-State Power Loss Characteristics



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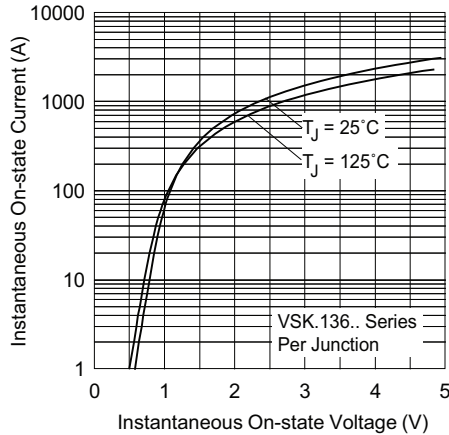


Fig. 28 - On-State Voltage Drop Characteristics

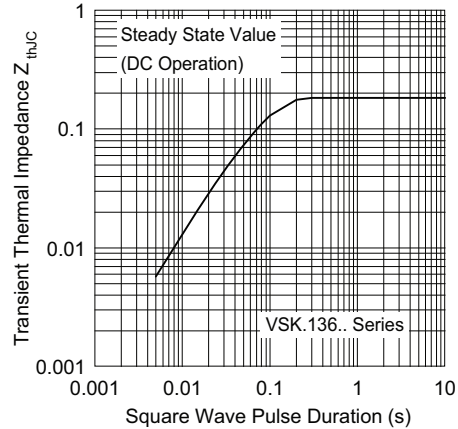


Fig. 31 - Thermal Impedance Z_{thJC} Characteristics

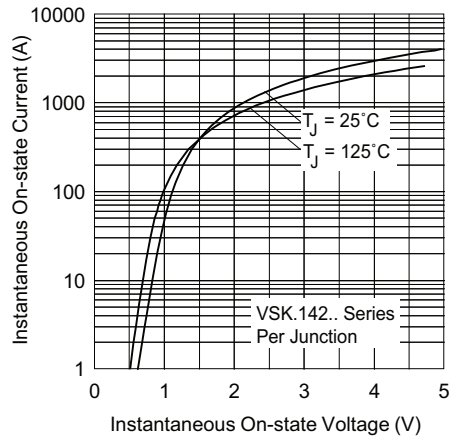


Fig. 29 - On-State Voltage Drop Characteristics

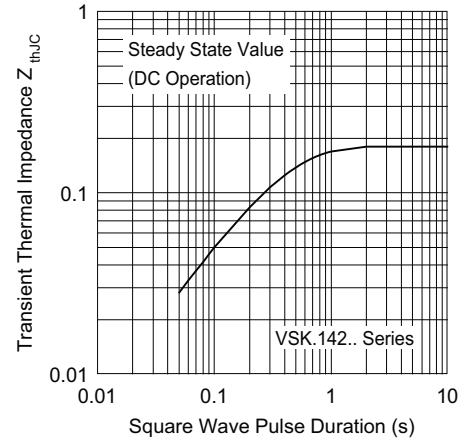


Fig. 32 - Thermal Impedance Z_{thJC} Characteristics

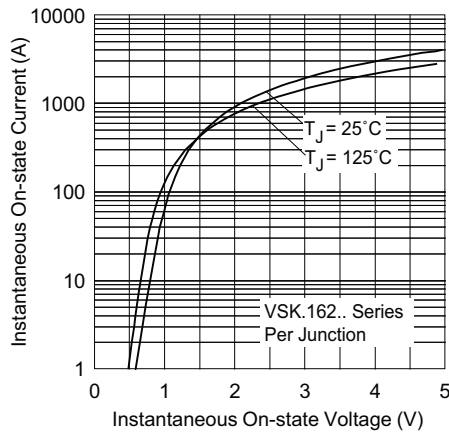


Fig. 30 - On-State Voltage Drop Characteristics

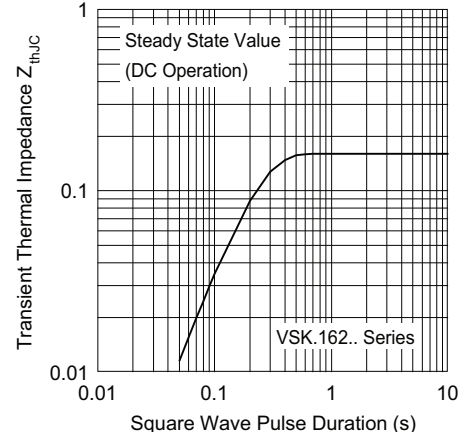


Fig. 33 - Thermal Impedance Z_{thJC} Characteristics



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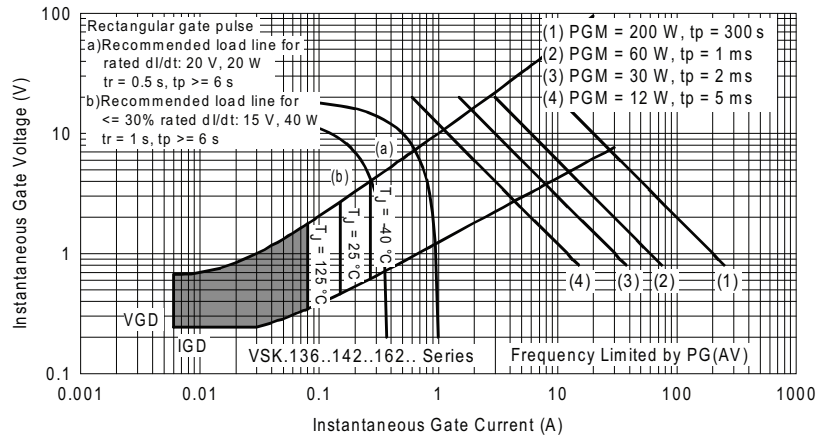


Fig. 34 - Gate Characteristics

ORDERING INFORMATION TABLE

| | | | | | |
|-------------|--------------|-----------|-------------------------------------|-----------|------------|
| Device code | VS-VS | KT | 162 | 16 | PbF |
| | ① | ② | ③ | ④ | ⑤ |
| | 1 | - | Vishay Semiconductors product | | |
| | 2 | - | Circuit configuration | | |
| | 3 | - | Current rating: $I_{T(AV)}$ | | |
| | 4 | - | Voltage code $\times 100 = V_{RRM}$ | | |
| | 5 | - | PbF = Lead (Pb)-free | | |

Note

- To order the optional hardware go to www.vishay.com/doc?95172



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| CIRCUIT CONFIGURATION | | |
|---|----------------------------|-----------------|
| CIRCUIT DESCRIPTION | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING |
| Two SCRs doubler circuit | T | |
| SCR/diode doubler circuit, positive control | H | |
| SCR/diode doubler circuit, negative control | L | |

| LINKS TO RELATED DOCUMENTS | |
|----------------------------|--|
| Dimensions | www.vishay.com/doc?95067 |

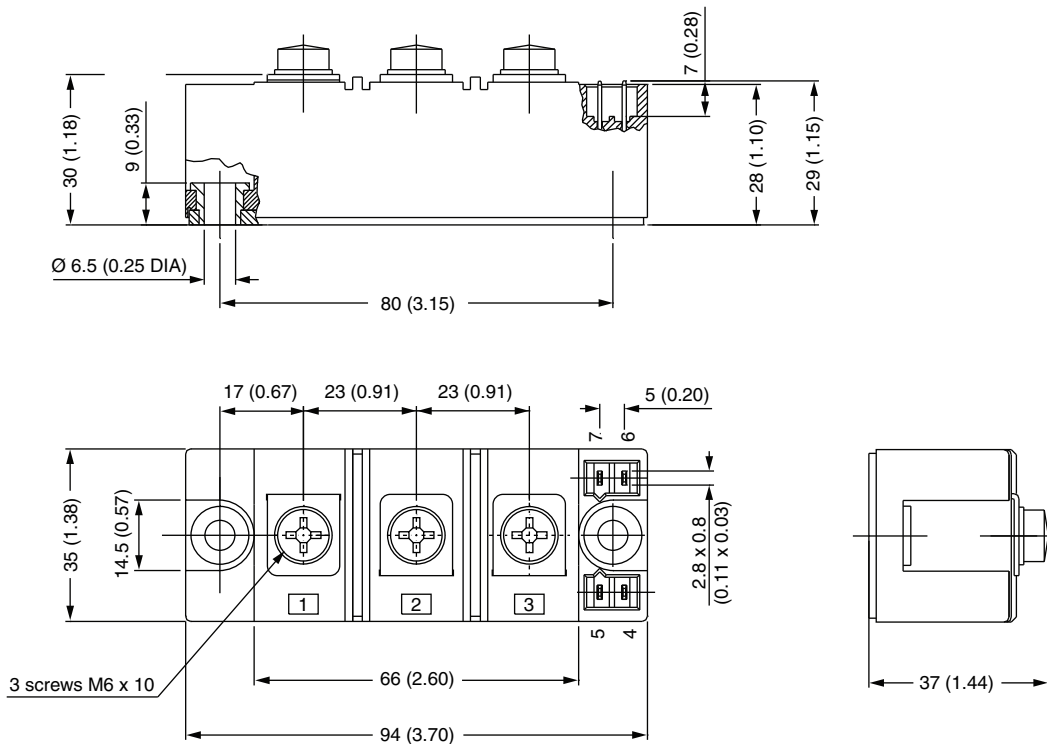


Outline Dimensions

Vishay Semiconductors

INT-A-PAK IGBT/Thyristor

DIMENSIONS in millimeters (inches)





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